ART. XII. *Microscopical Observations on Portions of Animal Tissue, with Additional Experiments on Endosmose and Exosmose.* By WILLIAM W. VALK, M. D. of Providence, R. I.

THE most generally received opinion of the present day respecting the tissues or organs of animals, is that they "are essentially composed of agglomerated globular, or vesicular cells." The strongest proofs have not long since been given of this arrangement by Dr. MILNE EDWARDS; and Dr. TOGNO observes, that every tissue can be solved into globules, which are every way *so similar*, that an observation with the microscope can discover *no difference* between *brain* and *liver*. I cannot, however, acquiesce in this doctrine of homogeneous structure, as to me it seems *contrary* to the experience of some of the greatest anatomists both living and dead.

The views of DUTROCHET on this subject do not *essentially* differ from those of HALLER, HUNTER, BECLARD, or CUVIER; all these authors having been satisfied of the "agglomerated globular, or vesicular structure." Beclard, however, has two opinions on this point, as may be seen on reference to his work—Additions à Bichat, pp. 15, 19, and 23, which I quote on the authority of BOSTOCK.

In detailing my experiments with the *microscope*, I shall endeavour to describe appearances *as I saw them*, without entering into any speculative discussion. I may remark, that my microscope is one of the best of its kind.

Experiments.—No. 1. *Nov. 28th.*—A small portion of the intestine of a recently killed fowl, on the internal surface of which the villi were distinctly visible to the naked eye, was submitted to the power of a lens of 800. On bringing it to the proper focus, it appeared of uniform consistence and colour, opaque and tremulous like jelly. No other appearances were observed while it remained still, which induced me to move and touch it with a small steel needle, when I was surprised to observe *innumerable small openings* for some distance around the needle's point, and through which the rays of the sun were brilliantly reflected. When the needle was held perfectly still, or removed from the surface, the orifices closed up, (if I may so express it,) and the same uniform and dull appearance was again presented to the eye.

Nos. 2 and 3, were repetitions of the above with *other* portions of intestine, and the same results were manifested.

No. 4. A small piece of the crop near its larger orifice was placed

in the focus of a lens of the power of 500. While *undisturbed*, I could not observe any peculiarity on touching its surface, and moving it gently from side to side, numerous orifices were seen in different clusters, and some single, which closed up, or became obliterated from the *circumference* to the *centre*, when the needle was held quiet or taken away.

These experiments were no less surprising than unexpected to me, yet I cannot allow myself to have been *deceived*, for the o*rifices* or o*penings*, or *transparent vesicles*, (or whatever else they may be called,) were as *distinctly visible* as the paper on which I am writing; and I hope that some other gentleman will investigate the subject, and make his observations known.

If *pores* do exist in *animal membranes*, then Boyle was not so far out of the way of probability when he spoke of the "porositas animalium."

The experiments which I shall now proceed to detail, were made with a view to satisfy myself of the phenomenon of endosmose and exosmose, and I have only to observe here, that they were conducted with as much care as possible, and the results of *some* of them will be found at variance with those of Drs. Togno and Dutrochet.

Experiments—First series.—The abdominal contents of seven fowls, killed the day before, were perfectly cleaned, as also the crops, and parts of them selected for experiment.

Nov. 28th, 10 *A. M. Fahrenheit's Thermometer from* 50° *to* 54°.—No. 1. Two portions of intestine, each three inches long, were half-filled with gum Arabic solution,* ligatures carefully applied, and then placed in a basin of clear water.

No. 2. Two crops, No. 1 and 2. were half-filled with a similar solution, ligatures firmly applied to their natural orifices, and both put in a basin of water.

No. 3. Two cœca, each three inches long, were *quite filled* with water, their extremities tied, and then plunged in a solution of gum.

No. 4. Four portions of intestine, in an empty state, with ligatures on their extremities, were immersed in clear water.

After completing the above, I went on, and commenced the following, with a solution of the *carb. potassæ*—proportions ℥j—water ℥xij.

Alkalies—Second series.—No. 1. Two crops, No. 1 and 2, con-

* The proportion of gum Arabic was ℥iss. to ℥viij. of water.

taining a portion of the solution, were put in water—No. 1 weighs 373 grains—No. 2, 354 grains.

No. 2. Two cœca, containing a small quantity of the same solution, and weighing 100 grains, were also put in water.

No. 3. Two portions of intestine containing *water*, No. 1 weighing 34 grains, and No. 2, 46 grains, were put in the *alkaline solution*.

This done, I began with the *acids*—proportions ʒj—water ℥viij.

Acids—Third series.—No. 1. A cœcum containing *diluted acid*, and weighing 60 grains, was put in water.

No. 2. A cœcum, containing the *diluted acid*, and weighing 80 grains, was put in water.

No. 3. A cœcum, containing *water*, and weighing 39 grains, was put in the diluted acid.

No. 4. A cœcum, containing *water*, weight 46 grains, was put in the diluted acid.

At 12 M. I commenced the following, with a solution of opium—5 grains to ℥ij. of water.

No. 1. A portion of intestine containing some of the solution, and weighing 60 grains, was put in water.

No. 2. A piece of intestine, containing water, and weighing 108 grains, was put in the solution of opium.

First Examination.—Nov. 29th, 9 A. M. Thermometer 40°, *twenty-three hours having elapsed.*

First series.—No. 1. Both portions of intestine *nearly* full. Endosmose.

No. 2. The two crops *remain stationary*, neither endosmose or exosmose having occurred as far as I can perceive. The ligatures were examined, and found tight. I cannot account for this; it is singular, and different from what I expected.

No. 3. The two cœca are *quite empty;* as they were *full*, rapid *exosmose* has occurred.

No. 4. *Two* of the *four* portions of intestine have become *nearly full*, the other two half-full. Endosmose.

Alkalies—Second series.—No. 1. The two crops were carefully dried and weighed. No. 1 weighs 665 grs.; has gained 292 grs. No. 2 weighs 527 grs.; has gained 173 grains.

No. 2. The two cœca were weighed together as before—weight 86 grs. loss 14 grs.—result not expected—ligatures tight. They ought to have *gained*.

No. 3. Intestine No. 1 weighs 36 grs.; *gain*, 2 grs. Intestine No. 2 weighs 509 grs. gain 4 grs. Endosmose instead of exosmose.

Acids—Third series.—No. 1. Weighs 60 grs. neither gained nor lost.

No. 2. Weighs 85 grs.; has gained 5 grs.

No. 3. Weighs 39 grs.; has neither lost or gained.

No. 4. Weighs 44 grs.; has lost 2 grs.

With the solution of *opium* the result is as follows:—

No. 1. This weighs 63½ grs.; has gained 3½ grs. Endosmose.

No. 2. Weighs 100 grs.; has lost 8 grs. Exosmose.

All of the preceding were again placed in their proper vessels, the contents of which remained *unchanged.*

Before I examined the above experiments for the *second* time, I began the following, which is something similar to the experiments of Dr. Staples, and suggested by them.

8½ *P. M.* A solution of the hydro-cyanate of potash, in the proportion of ℈j. to ℥viij. of water, was put into a small glass vessel, over the month of which I carefully and accurately fastened a piece of the crop of a fowl. Into a tumbler I poured a small quantity of a solution of sulphas ferri, and introduced the one into the other, but not so deep as to allow the latter to rise above the edge of the crop. In *one minute* both sides of the membrane became spotted with a beautiful blue colour, and in fifteen the whole of the two surfaces was stained. At this time I put it aside to examine the other experiments.

Second Examination.—Nov. 29th, 9 *P. M. Thermometer* 44°, *twelve hours having elapsed.*

First series.—No. 1. One of these portions is *full,* the other not quite so; endosmose still going on.

No. 2. In the crops *no change* has occurred, they being to all appearance just as I filled them.

No. 3. The cœca are now quite shrivelled up; exosmose perfectly satisfactory; dismissed.

No. 4. Two of the portions of intestine are full, the other two nearly so; endosmose still continuing.

Alkalies—Second series.—No. 1. The two crops were again carefully weighed. No. 1 weighs 714 grs.; has *gained* 49 grs. No. 2 weighs 569 grs; has *gained* 42 grs.

No. 2. The two cœca now weigh 82 grs. having *lost* since morning 4 grs.

No. 3. Intestine No. 1 weighs 39 grs.; has *gained* 3 grs. No. 2 weighs 53 grs.; has also *gained* 3 grs.

Acids—Third series.—No. 1. Weighs 60 grs.; *no change.*

No. 2. Weighs 84 grs.; has lost 1 grain.

No. 3. This still weighs 39 grs.; *no change.*

No. 4. Weighs 42 grs.; has lost 2 grs.

Solution of Opium.—No. 1. Weighs 64 grs.; gain, *half* a grain.

No. 2. Weighs 98 grs. having lost 2 grains.

After this examination, *all* of the above were again placed in the same vessels, the water and solutions remaining *unchanged.*

Third Examination.—Nov. 30th, 9 A. M. Thermometer 43° to 44°.

First series.—No. 1. Both portions of intestine are now *quite full;* I weighed them and found their weight to be 160 grs. Water changed.

No. 2. These crops still remain "*in statu quo,*" as far as I can judge. I now weighed them; No. 1 weighs 440 grs ; No. 2, 426 grs.; shall observe if there be any loss or gain of weight by evening. Water changed.

No. 4. All four portions are now full; they weigh 110 grs.; let them remain.

Second series:—No. 1. Crop No. 1 weighs 762 grs.; has gained 48 grs. No 2 weighs 604 grs.; has gained 35 grs. The water renewed.

No. 2. The two cœca weigh 75 grs.; have *lost* 5 grs. since last night.

No. 3. Intestine No. 1 weighs 40 grs.; has gained 1 gr. Intestine No. 2 weighs 54 grs.; has also gained 1 gr. The solution changed.

Third series.—No. 1. Weighs 57 grs. has lost 3 grs. Water and diluted acid changed.

No. 2. Weighs 80 grs.; lost 4 grs. Water and diluted acid changed.

No. 3. Weighs 38 grs.; lost 1 gr. Water and diluted acid changed.

No. 4. Weighs 42 grs.; *no change.* Water and diluted acid changed.

Solution of Opium.—No. 1. This intestine weighs 65 grs.; has gained 1 gr. Water changed.

No. 2. Weighs 96 grs.; has lost 2 grs. Solution changed.

Having now accomplished the third examination of the preceding, I proceeded to observe the change that had taken place in my experiment with the *prussiate of potash* and *sulphate of iron.* After a lapse of fifteen hours, I found that the *sulphate* had penetrated the coats of the crop by *endosmose,* and produced with the *prussiate* a *deep green-blue colour,* but *not a particle* of the latter salt had escaped by *exosmose.* In this Journal for February, 1830, Dr. Jackson at page 286, observes, with respect to the experiments of Dr. Staples, that when the *prussiate* was the *contained* salt, "it *escaped* by *exosmose* externally, and formed Prussian blue by meeting with the sulphate of iron." Here then my experiment and this observation are at *variance,* for I placed the *prussiate in* the vessel, and confined it

there by a portion of crop, and this being inverted in a solution of the sulphate, *endosmose* took place, the *sulphate entered* the vessel, and formed the blue colour *within* it. Is it not evident, that had the *least portion* of the *prussiate* "escaped," a blue colour would have been given to the *external* solution? From my experiment, I should infer, that animal tissues not only "*expel* saline matters by *exosmose*," but also *introduce* them by *endosmose*. But as this experiment was unsupported by others, I resolved to repeat it, and to make a *nearer* approach to those performed by Dr. Staples. Accordingly I procured *two crops* and *two pieces* of intestine, each three inches long, with which I commenced the following:—

Ex. 1.—*Nov.* 30*th*, 4 *P. M.* The two portions of intestine were rather more than half-filled with a solution of sulphate of iron, and then immersed in a solution of prussiate of potash. The ligatures were *carefully* and *firmly* tied.

Ex. 2.—8 *P. M.* The crops were partly filled with a solution of prussiate of potash, their orifices tied, and then put in a solution of sulph. ferri. As soon as the above were immersed, the coats of the intestines and crops became more or less blue, particularly the former, and this will almost always happen.

It being now time to examine my *other* experiments, I put the above aside.

Fourth Examination.—Nov. 30*th*, 9 *P. M. Thermometer* 48°.

First series.—No. 1. Both portions weigh 155 grs.; have lost 5 grs. since morning; dismissed.

No. 2. Crop No. 1 weighs 464 grs. having gained 24 grs. in twelve hours, and this has only become obvious by weighing it. No. 2 weighs 431 grs.; has only gained 5 grs.; dismissed—very imperfect.

No. 4. All quite full; weigh 119 grs.; gain since morning, 9 grs.

Second series.—No. 1. The first crop now weighs 832 grs.; has gained 70 grs. The second now weighs 636 grs.; gain, 32 grs. These are dismissed as satisfactory.

No. 2. The cœca weigh 78 grs.; have gained 8 grs.; dismissed.

No. 3. Intestine No. 1 weighs 42 grs.; gain, 2 grs. No. 2 weighs 54 grs.; stationary—unsatisfactory—dismissed.

Third series.—No. 1. Weighs 58 grs.; has gained 1 gr.

No. 2. Weighs 79 grs.; has lost 1 gr.

No. 3. Weighs 85 grs.; has lost 8 grs.

No. 4. Weighs 39 grs.; has lost 8 grs.; all dismissed, unsatisfactory.

Solution of Opium.—No. 1. Weighs 64 grs.; has lost 1 gr.

No. 2. Weighs 96 grs.; has remained stationary; dismissed.

Fifth Examination.—December 1*st*, 9 *A. M.*

On examining my experiments with the *prussiate of potash* and *sulphate of iron*, I fonnd the following results.

Ex. 1. These pieces of intestine are deeply dyed on the *outer* surface; the liquor in which they were *immersed* is of a *dark blue colour*, but their *contents perfectly transparent.* From these appearances, it is sufficiently evident that the *sulphate* of *iron* has passed *from within outwards* by *exosmose*, aud produced "Prussian blue in meeting with the prussiate of potash." So far then, *this* experiment *agrees* with those of Dr. Staples.

Ex. 2. These crops on examination have afforded additional evidence that "animal tissues" can introduce "saline matters" by *endosmose*, for the solution in which they were placed, remains as *clear* as at first. The most perfect *endosmose* has taken place, and the *sulphate* has penetrated the coats of the crops, and meeting with the *prussiate*, has formed the Prussian blue. Therefore, I hold it to be *proved*, that "animal tissues" can "expel" *some* "saline matters by exosmose," but that they have *not* this property with regard to the *prussiate of potash.*

A considerable *sediment* was left in the vessels in which the *crops* had been immersed. The strength of the solutions was 30 grs. of the salts to ℥viij. of water.

Dr. Jackson has stated, that when the *prussiate* was introduced into the "small sacs," it was *expelled* by *exosmose*, but as I have not been fortunate enough to find it so; where lies the error?

All of my experiments have been performed in the *most careful manner* with intestines, cœca, and crops of fresh-killed animals; my ligatures were of waxed silk, and they were as cautiously applied as possible.

Were my solutions too strong, or was the temperature of the atmosphere too cold? Be the causes what they may, it is certain that *some* of the results which I have obtained, are contrary to my own expectations, and to *some* of the experiments of Drs. Togno and Dutrochet.

I now claim the indulgence of a few observations, and shall make them as brief as possible.

The No. 1 of my first series was throughout a very good instance of the action of *endosmose.*

No. 2. In this I was disappointed, the crops remaining to all appearance stationary until the *fourth* examination, when, by weighing them, I found in one a gain of 24 grs.; in the other, a gain of only 5. I know not why this so happens, and felt quite unsatisfied.

No. 3. A very perfect and beautiful illustration of the action of *exosmose.*

No. 4. These were also very good examples of *endosmose,* but as they were originally empty, they offer no illustration of *electrical* agency.

Second series.—No. 1. This was the best example of endosmose among the whole, and I think the alkalies better calculated to produce it than a solution of gum.

No. 2. These are out of order; instead of endosmose we had exosmose, and at the last examination only were they found to have gained at all.

No. 3. These are also wrong; here we had endosmose, when, according to Drs. Togno and Dutrochet, we ought to have had exosmose.

Third series.—No. 1.

Nos. 2, 3, and 4. All the results are very unsatisfactory. See Togno, in this Journal, No. VII. May, 1829, p. 81—acids, Ex. 3.

With the solution of opium I have obtained such results as would tend to show that this substance does not produce its effects by absorption, but solely by its action on the nerves of the part with which it is in contact. This is, however, but an opinion.

I do not now wish to enter into a discussion on the merits of Dr. Dutrochet's discovery, or respecting the cause which produces these singular actions. It appears to me, however, that neither electricity or galvanism are necessarily connected with the subject. In conclusion, I beg leave to state, that I differ with Dr. Togno as regards the positions laid down in his 2d, 3d, 8th, 10th, 12th, 17th, and 18th observations; for which, see his paper, as already quoted.

Providence, R. I. Dec. 1*st*, 1830.

ART. XIII. *Remarks on a Contrivance for Draining the Thorax of Liquids, excluding at the same time the Admission of Air.* By SAMUEL A. CARTWRIGHT, M. D. of Natchez.

THE fact, that liquids can be conducted out of the thorax by a contrivance impervious to air, is new in surgery, and may be found important in the treatment of many cases of wounds of the lungs, empyema, and dropsy.

By a letter now before me, from Dr. J. M. B. THOMPSON, of Louisiana, I am informed, that in three cases of hydrothorax he conducted the water out of the cavity of the chest, prevented at the same time the ingress of air, and cured his patients speedily and effectually.